CHAPTER 6 GROUNDWATER PROTECTION PROGRAMS/ASSESSMENT

The 2005 USGS Water Use report (http://pubs.usgs.gov/circ/1344/) estimated that approximately 2.2 million Virginians depended on groundwater for their domestic supply. Approximately 3 out of every 10 Virginians use groundwater from public water supplies, private wells, or springs for their daily water supply. While Virginia's groundwater is generally of good quality, both the quality and quantity can vary across the five physiographic provinces found in the state. Reliance on groundwater is also highly variable across the state, depending on a variety of geographic, geologic, and socioeconomic factors.

General groundwater quality information by physiographic province:

Cumberland Plateau
Geology: Sedimentary rock yielding groundwater of varying quality
Pollution Potential: Moderate

The Cumberland Plateau province, encompassing the Southwestern tip of Virginia, is underlain by sedimentary rocks, principally sandstone, shale, and coal. Groundwater quality here varies with depth. The first 100 feet of rock below stream level is often of poor quality, tending to be sulfurous and iron-rich, and naturally saline waters occur at depths greater than 300 feet. Better quality water can be found at depths of 150 to 300 feet below stream level. In coal mining areas, some groundwater has become acidic due to mine drainage and is usually unsuitable for most uses.

Valley & Ridge
Geology: Sedimentary rocks including limestone, dolomite, and shale
Pollution Potential: High in limestone areas where groundwater moves rapidly

Consolidated sedimentary rocks deposited beneath ancient seas underlie the Valley and Ridge Province to the west of the Blue Ridge. In the lowlands, such as the Shenandoah Valley, limestone and dolomite occur beneath the surface forming the most productive aquifers in Virginia's consolidated rock formations. In contrast, sandstone and shale are the rock types often present in the ridges and upland areas, which yield only enough water for rural and domestic supplies.

The connection between groundwater and surface water plays a major role in groundwater recharge in the Valley and Ridge. Recharge may also occur through surface run-off into limestone sinkholes, bypassing filtration through the soil. This can cause serious water quality problems since polluted surface water may be introduced directly into the groundwater system. Groundwater quality can also be adversely affected by private trash dumps located in sinkholes that receive surface run-off. In addition, carbonate formations contribute to the "hardness" of the groundwater.

The karst limestone type of terrain in the valley poses difficult problems for wellhead protection area delineation since underground conduits may act much like surface rivers. Some studies have suggested that surface water drainage patterns may be the best way to delineate wellhead protection areas in such circumstances.

Blue Ridge
Geology: Sedimentary, igneous, and metamorphic rock; well yields are low
Pollution Potential: High, because of rapid movement of water in fractures, joints, and bedding planes

The Blue Ridge Province is a relatively narrow zone to the west of the Piedmont, from 4 to 25 miles wide, with mountains of some of the highest elevations in the state. Beneath a thin layer of soil and weathered rock lies the bedrock, a relatively impervious zone containing water primarily in joints, fractures, and faults. On the eastern flank of the Blue Ridge, igneous and metamorphic rocks are most common while sedimentary rocks are more common on the western flank. Steep terrain and thin soil covering result in rapid surface run-off and low groundwater recharge.

There has been little residential or industrial development in the Blue Ridge itself, so groundwater use has been mainly for domestic needs rather than for public wells. The lower slopes of the mountains are the most favorable areas for groundwater accumulation. Springs are common and are often used for private water supplies.

Piedmont
Geology: Diverse geology with a wide range of groundwater quality and availability
Pollution Potential: Low to moderate

The largest physiographic province in Virginia is the Piedmont, extending from the fall line on the east to the Blue Ridge Mountains in the center of the state. Hard, crystalline igneous and metamorphic formations dominate this region with some areas of sedimentary rocks and saprolite deposits overlying the bedrock. The size and number of fractures and faults in the bedrock which store and transmit groundwater decrease with depth, so most significant water supplies are found within a few hundred feet of the surface. Fairly large yields of water can be obtained where fracture and fault systems are extensive such as the Western Piedmont along the base of the Blue Ridge Mountains.

The diversity of the subsurface geology of the Piedmont Province results in wide variations in groundwater quality and well yields, with groundwater use at many locations limited. A few areas, for example, have problems with high iron concentrations and acidity. Because of the range in groundwater quality and quantity in this region, as well as the subsequent varying potential for contamination, well site evaluation and well monitoring is very important here. From a wellhead protection standpoint, assumptions about the porosity and permeability of the overlying saprolite may have to be made so that reasonable estimates of wellhead protection areas can be calculated.

Coastal Plain
Geology: Unconsolidated sand, clay, marl, and shell strata; groundwater is abundant and use is high
Pollution Potential: High, due to geology and population density

The Coastal Plain in Virginia extends inland from the coast about 110 miles to the fall line and passes roughly through Fairfax County, Fredericksburg, Richmond, Petersburg, and Emporia. The Eastern Shore is part of this region and the two counties there have been conducting studies for several years to develop a more detailed understanding of their groundwater situation. The Coastal Plain region is the only province in Virginia that is composed mostly of unconsolidated deposits, primarily alternating layers of sand, gravel, shell rock, silt, and clay. More groundwater is stored in these very permeable materials than in any other province in the state. The pollution potential in the uppermost unconfined aquifer is high because of the permeability coupled with the high population density and substantial agricultural activities in the area.

A large portion of the state's groundwater use occurs in the Coastal Plain, which has two separate groundwater systems, one shallow and one deep. In many places, a shallow unconfined aquifer system lies above relatively impermeable clay beds and is the source of water for hundreds of domestic and other small capacity wells. The principal source of major groundwater withdrawals is a deeper system of confined aquifers. The coastal plain presents a complex wellhead protection problem where the deep confined aquifers are concerned. The shallower aquifer, however, may have a more direct interaction with the surface and presents a relatively straightforward challenge.

Except for areas where saltwater, iron, and hydrogen sulfide occur, the natural water quality in the Coastal Plain aquifers is good. In aquifers near a salt water interface, salt water may migrate west as aquifers are pumped. As a result, water from the deep aquifers on much of the lower York-James Peninsula and the Norfolk-Virginia Beach area generally contains high chloride concentrations, rendering the water too salty for domestic use without treatment.

The following paragraphs briefly describe groundwater protection activities in the Commonwealth.

Information provided in Tables 6-1, 6-2, 6-3, 6-4 and 6-5 is presented for the Commonwealth as a whole.

Groundwater Protection Steering Committee

Groundwater programs in Virginia strive to maintain existing high quality water through adopted statutes, regulations, and policies. Advancing groundwater protection efforts is the goal of many programs in numerous state agencies. In late 1986, an interagency committee was formed to stimulate, strengthen, and coordinate groundwater protection activities in Virginia. The Groundwater Protection Steering Committee (GWPSC) continues to meet with representation from the following agencies:

Department of Environmental Quality (DEQ)
Department of Health (VDH)
Department of Mines, Minerals, and Energy (DMME)
Virginia Polytechnic Institute and State University (VPI&SU)
Department of Housing and Community Development (VDH&CD)
Department of Agriculture and Consumer Services (VDACS)
Department of Conservation and Recreation (DCR)
Department of General Services, Division of Consolidated Laboratories (DCLS)
United States Geological Survey (USGS)

Groundwater Characterization Program (GWCP)

During the 2005 session, the General Assembly passed legislation and provided funding to establish water supply and groundwater characterization programs within DEQ in response to negative impacts experienced by many localities, businesses, and domestic well users during the drought of 2002.

The Commonwealth is divided into three regions to include the Coastal Plain, Piedmont-Blue Ridge, and Valley-Plateau. The organizational objective of the GWCP is to protect Virginia's environment and promote the health and well being of its citizens by collecting, evaluating, and interpreting technical information necessary to manage groundwater resources of the Commonwealth. GWCP staff will assure that necessary information is available to support resource management decisions, water supply planning activities, groundwater availability, drought monitoring, and support the expansion or creation of groundwater management areas.

Initial efforts will include cooperation with other state and federal agencies involved with groundwater related activities to compile historical water well construction, withdrawal, and water quality data into a GIS database as well as develop procedures to automate the acquisition of new data. Long range goals include expansion of the State Observation Network west of the fall line and publication of regional groundwater resources reports.

<u>Regional Groundwater Reports</u>

During the late 1970s and early 1980s, State Water Control Board (SWCB) geologists compiled 18 groundwater resources reports to document the availability, utilization rates, and water quality of groundwater resources within selected counties and political sub-regions of Virginia. To date, the State Water Control Board groundwater resource reports are the only readily available source of information pertaining to the occurrence, movement, and availability of groundwater for a large number of the areas initially investigated. Although the majority of these historical reports are out of print, the reports are available electronically:
http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx

Current descriptions of the regional groundwater conditions in the Shenandoah Valley and Blue Ridge Geologic Province have been documented in two recently authored reports by Groundwater Characterization staff. Groundwater Resources of the Blue Ridge Province, Virginia (VDEQ OWS Technical Bulletin 12-01) and Water Use in the Shenandoah Valley, Virginia 1982-2010 (VDEQ OWS Technical Bulletin 12-02) are available electronically:
http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx
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Statewide Well Construction Database

Over the years, water well information has been collected by different state and federal agencies for a variety of purposes. Prior to the adoption of the Groundwater Act of 1973 (Chapter 3.4 of Title 62.1, Waters of the State, Ports and Harbors), collection and submission of water well reports was largely a voluntary effort. Agencies such as DMME – Division of Geology and Mineral Resources, USGS, VDH, and the SWCB had their own versions of water well reports and collected them for different purposes. With the advent of digital database management, water well completion report data have been compiled by multiple governmental agencies into databases of varying quality that are both static and actively managed.

One of DEQ's goals is to merge the various sources of historical and new well information into one statewide database that can be used for regional analysis of groundwater aquifer systems. Major challenges to this goal include managing data duplication and disparities among multiple data sets and quantifying location accuracy. Efforts to sort and merge this data were completed in 2010: http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/WellDatabase.aspx Since 2010, the database has grown from about 35,000 wells to nearly 57,000 wells. Additional wells have originated from a number of data sources including digitized data from water well drillers, the VDH VENIS and SDWIS databases, county specific well databases, and project specific data collected and entered into the database. Despite this database being the largest of its kind in Virginia, it is representative of a fraction of the millions of wells that have been drilled throughout the State. Most wells in Virginia have been and continue to be documented by a paper well completion report, unavailable electronically. The hydrologic conditions encountered by the driller will likely never be incorporated into a georeferenced database that could be utilized to better understand local hydrogeologic conditions. For this reason, DEQ continues to encourage the development of a streamlined process for accurately reporting the location and construction details of newly completed wells in a digital format.

Statewide Legacy Geochemical Database

The GWCP compiled a master database of legacy ambient water quality data of waters from wells and springs throughout the Commonwealth in 2010. Ambient water quality data comprising this database includes major ion geochemistry, trace elements, nutrients, radiologicals, and field parameters. Nearly 17,000 samples taken from approximately 8,500 geo-referenced wells and springs are currently in the data set. When combined with location data, ambient water quality samples from wells and springs provide valuable information about the background concentrations of naturally occurring ionic constituents and field parameters of groundwater flow systems. In addition to their value in describing the geochemical conditions within natural groundwater flow systems it is anticipated that these data will be used by municipalities, consultants, and state and federal agencies for a wide variety of applications such as determining the extent and magnitude of elevated ionic concentrations (above background levels) due to groundwater contamination from anthropogenic sources, for predicting chemical and biological interactions due to the contamination of groundwater, and for optimizing well placement to insure high quality drinking water for private residences and municipalities. In 2014 the database was revised to describe additional geochemical and field collected parameters and to accept recently acquired ground water sampling data from ambient groundwater monitoring efforts. The database is currently in review and will be made publically available after completion of the review process.

Statewide Legacy Spring Database

The GWCP is in the process of creating a statewide spring database. http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/SpringDatabase.aspx.

To date, spring locations are largely unmapped in most parts of the region and limited information is fragmented among DEQ, DCR, USGS, and DMME – Division of Geology and Mineral Resources about the location, discharge, and basic water quality of such waters. A comprehensive database of this basic information is necessary for any attempt to understand regional water resources in such complex terrains as the carbonate aquifers of western Virginia. These data have value to other programs in DEQ such as Pollution Response and Petroleum Storage Tanks that deal with subsurface contaminant transport and has recently been integrated into the development of certain TMDL studies in the Shenandoah Valley. Working agreements, standardized forms and definitions have been developed by GWCP that have been used by field personnel in sister agencies such as DCR and DMMR in order to multiply the rate of compilation of new springs into a central database containing spring locations, morphology, discharge, and basic geo-chemistry.

There are currently nearly 3,000 spring visit entries (which could include quantification of spring discharge and measurement of basic water quality parameters), and 330 water quality samples for the 925 springs in the database.

State Observation Well (SOW) Program

The DEQ collects data on groundwater levels at 225 wells and the USGS collects data on groundwater levels at 142 wells in the USGS/DEQ Groundwater Level Monitoring Network. One hundred thirty one of the wells in the DEQ/USGS observation well network have been converted to real time monitoring with levels measurements stored once every 15 minutes and uploaded hourly to the USGS server using satellite telemetry technology. Data from the wells in the DEQ/USGS observation well network are published in the Annual Water Data Report: http://wdr.water.usgs.gov/. Currently, DEQ/USGS water level data are available on a USGS interactive map browser at http://groundwaterwatch.usgs.gov/StateMaps/VA.html. The information provided by the research stations is important for monitoring drought conditions, determining when groundwater recharge actually occurs, and monitoring the effects of groundwater withdrawal. Additionally, the groundwater level data collected cooperatively by the DEQ and USGS contributes to a long-term Coastal Plain groundwater modeling project.

Since 2010, 21 wells have been added to the state observation well network. All additions during this time have occurred in the Coastal Plain for the purpose of monitoring hydraulic heads in the multi-aquifer Coastal Plain groundwater system. Additional wells have been flagged for incorporation into the state observation well network in the hard rock portions of Virginia and will be brought into the network as time and resources permit.

Geochemical Sampling Program Development

In 2013, the GWCP developed an ambient groundwater quality monitoring strategy document to serve as a plan for characterizing groundwater geochemical conditions throughout the Commonwealth. The document describes the extent of currently available groundwater chemistry data, provides a rationale and methodology for a scientifically defensible distribution of sampling resources, and provides a cost analysis for the full implementation of the sampling strategy. Additionally, an annual implementation plan was developed detailing the portions of the sampling strategy in each geologic terrain that will be accomplished with respect to that fiscal year's budgetary considerations. The Virginia

Ambient Groundwater Monitoring Strategy and the FY14 Ambient Groundwater Quality Monitoring Implementation Plan were finalized in November of 2013 after review and input from a variety of federal, state and private organizations and institutions. The strategy and FY2014 implementation plans can be viewed at http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterCharacterization/ReportsPublications.aspx .

Development of the strategy included testing and modification of sampling equipment and methodology in order to attain the highest sampling quality control possible in the range of geologic, hydrologic, and well construction conditions encountered throughout the state. Groundwater samples were obtained at selected wells and springs in Virginia during the 2013 calendar year and continue to be collected in accordance with the finalized 2014 implementation plan. A fiscal year 2015 implementation plan will be made available in July of 2014 that will detail an increase in sampling activities for the period due to budgetary changes and the addition of staff to the GWCP. In 2016, a compilation and analysis of groundwater sampling performed by GWCP staff in calendar years 2013 - 2015 will be made available to the public.

EPA/DEQ/USGS Cooperative Studies

DEQ continues to cooperate with the USGS on a multi-year effort to update and revise the hydrogeologic framework utilized to better manage the groundwater resources of the Virginia Coastal Plain. Updated models for the Virginia's mainland Coastal Plain and Virginia's Eastern Shore were delivered in 2008. Additionally, the cooperative effort between DEQ and the USGS to update the hydrogeologic framework has resulted in the publication of an award winning Professional Paper #1731, The Virginia Coastal Plain Hydrogeologic Framework, coauthored by E. Randolph McFarland (USGS) and T. Scott Bruce (DEQ). The paper is available online at http://pubs.usgs.gov/pp/2006/1731/pp1731_download.htm . This report presents the results of a multiyear study done in cooperation with the DEQ, the USGS and the Hampton Roads Planning District Commission with funding provided through EPA Clean Water Act grant funds. The report provides an in-depth synthesis and new region-wide interpretation of information from the Chesapeake Bay impact crater studies and from other recent studies. The report makes available a timely revision and update of the hydrogeologic framework for the Virginia Coastal Plain that was developed during the USGS Regional Aquifer-System Analysis (RASA) program.

With advancement of a new regional understanding of the Virginia Coastal Plain aquifer system, effective management of the groundwater resource is further predicated on knowledge of its chemical quality. A significant amount of ground-water quality has been generated from diverse sources in the last twenty years but was not collectively summarized. . A USGS Professional Paper entitled, "Ground Water Quality Data and Regional Trends in the Virginia Coastal Plan, 1906-2007" was published in 2010; this publication summarizes this water quality information to improve our understanding of the aquifer system.

Groundwater Withdrawal Permitting Program

The Virginia General Assembly adopted the Ground Water Act of 1992 (Act) and repealed the Ground Water Act of 1973. The Act establishes criteria for the creation of groundwater management areas and requires entities that withdraw more than 300,000 gallons of groundwater in any month to obtain a permit. The Act also requires previously exempted agricultural groundwater withdrawals to obtain groundwater withdrawal permits. The DEQ adopted the Groundwater Withdrawal Regulations to implement the Act effective September 23, 1993 and amended those regulations January 1, 1999. This regulation added specific requirements for agricultural groundwater withdrawal permits and required DEQ to perform technical evaluations of those proposed withdrawals.

Further regulatory actions beginning in 2009 have resulted in the January 1, 2014 expansion of the Eastern Virginia Groundwater Management Area to include all of the Coastal Plain along with a Final 2014

revision to the regulations to promote a more consistent permitting approach as implemented in other DEQ water permitting programs. These actions allow for DEQ to take a more comprehensive approach to the long-term management of groundwater within the Coastal Plain as well as more efficient permitting.

Additionally DEQ has begun using VAHydro-GW as the new modeling tool for technical evaluations. This model evolved over time originating from the Regional Aquifer-System Analysis (RASA) Groundwater Flow Model (1988) and the Virginia Coastal Plain Model (VCPM). Technical Evaluations that are produced from the use of the model are used to compare hydrogeologic framework, compare water levels, analyze aquifer pump tests, run regional modeling, determine the area of Impact (AOI), evaluate the 80% drawdown criteria (critical surface), assess water quality changes and prepare maps.

Storage Tank Compliance Program

The Registration Program tracks ownership and technical information for more than 16,000 owners of 79,500 Underground Storage Tanks (USTs) and Aboveground Storage Tanks (ASTs) at 28,000 facilities in the Commonwealth. Each year the program receives over 2,000 registrations that report new tanks, tank closures, and amendments to existing tank information, such as changes of ownership. DEQ and the public use the registration information to determine the identity of persons responsible for pollution prevention measures and cleanup of releases.

The AST Compliance Program regulates AST facilities of 25,000 gallons or greater that store oil. Nearly 1.4 billion gallons of oil are stored in the 3,600 active regulated AST facilities across the Commonwealth. Through facility inspections, the program seeks to ensure that Virginia's AST facilities have measures in place to prevent releases and to respond quickly and effectively if releases occur.

The UST Compliance Program regulates USTs larger than 110 gallons that contain regulated substances, which include most petroleum products. Over 169 million gallons of regulated substances are stored in the 18,000 active USTs across the Commonwealth. Through tank inspections, the program seeks to ensure that USTs in the Commonwealth have measures in place to prevent releases and to have immediate notice of actual releases.

On August 8, 2005, President Bush signed H.R. 6, the Domenici-Barton Energy Policy Act of 2005. In Title 15 of the Act are amendments to Subtitle I of the Solid Waste Disposal Act addressing the regulation of underground storage tanks (primarily petroleum). Based upon EPA guidelines, DEQ revised its regulations on September 15, 2010 to incorporate UST secondary containment, delivery prohibition and operator training requirements.

The existing State Water Control Law (§62.1-44.34:9(2) & (8)) requires DEQ to carry out its powers and duties with regard to underground storage tanks in accordance with applicable federal laws and regulations.

Storage Tank Remediation Program

The Remediation Program directs the investigation and cleanup of petroleum-contaminated sites managed by responsible parties. The DEQ ensures that appropriate emergency response, initial abatement measures, site investigation and site remediation are performed by the responsible party. The DEQ also authorizes activities eligible for reimbursement from the Virginia Petroleum Storage Tank Fund.

The DEQ will conduct investigation and cleanup of high-priority petroleum contaminated sites in instances where the responsible party is unknown or financially unable to undertake the required work. Through a number of contractors, the DEQ conducts emergency response, initial abatement measures, site investigation and site remediation.

The DEQ also provides immediate, interim, and permanent relief to individuals whose drinking water wells have been rendered unusable by petroleum contamination. Through a DEQ contractor, carbon filtration units (CFUs) are installed and maintained on contaminated wells until a permanent solution is implemented. Permanent solutions typically include extension of an existing public water supply or installation of a new well free from petroleum contamination.

More than 9,500 site cleanups were completed from January 2005 through December 2010. Average cleanup time and average cleanup costs per site are among the lowest in the nation.

Office of Solid Waste Activities

The DEQ's Office of Solid Waste implements the requirements for groundwater monitoring and corrective action as originally defined under Subtitle D of the Resource Conservation and Recovery Act (RCRA). Funding for the program comes from the Commonwealth's General Revenue augmented by permit fees. All groundwater data are collected by the solid waste facilities and their consultants and reviewed by DEQ staff for adherence to regulatory requirements under 9 VSWMR 20-81-250 and 260.

Information provided in Table 6-4 Solid Waste Landfill Corrective Action category was derived for the sites in Virginia's Solid Waste Corrective Action universe, as reported through December 2012. More than 100 sites have been identified as having the potential for impacts on human health and the environment by exceeding one or more of their groundwater protection standards. In cases where groundwater monitoring detects exceedences above groundwater protection standards (such as EPA's Maximum Contaminant Levels for drinking water), facilities are required to implement clean-up measures under a process called groundwater Corrective Action. As shown in Table 6-4, the number of sites which have implemented groundwater Corrective Action across the Commonwealth is 59. To date, two landfill sites have met their groundwater clean-up goals and have been allowed to terminate corrective action.

Office of Remediation Programs

Included in Table 6-4 are groundwater contamination statistics from the DEQ's Office of Remediation Programs (ORP). ORP consists of the Federal Facilities Restoration Program, Superfund Program, Voluntary Remediation Program, Site Assessment Program, and the Brownfields Program. The Federal Facilities Restoration (FFR) Program includes 44 Army, Navy, Marine Corps, Air Force, Defense Logistics Agency, Federal Aviation Administration, and NASA installations and 12 Formerly Used Defense Sites (FUDs) Two Federal Facilities recently added to the FFR Program are Camp Pendleton and Reagan National Airport. Currently 12 Federal Facilities and 1 FUDs site are listed on the National Priority List (NPL). The mission is to clean up contaminated sites at military installations through a partnering team process. The Department of Defense, NASA, and the EPA support the program. The Superfund Program, funded with both Federal and State dollars, carries out activities required by law or legal agreements at 22 NPL sites. Four of these sites have now been cleaned up and delisted. The Voluntary Remediation Program (VRP) provides a mechanism for eligible participants to voluntarily clean up properties not mandated for remediation under existing environmental laws. This program serves as a mechanism for cleanup of brownfields sites. There are over 430 sites that are active in the program or have been cleaned up under the program. EPA funding supports the Voluntary Remediation Program. The Site Assessment Program (SAP), supported by EPA, is designed to assess potential CERCLA sites for inclusion on the NPL. The DEQ's Brownfields Program, also supported by EPA, provides incentives to owners and/or developers of potential brownfield sites to promote the redevelopment and reuse of these underutilized properties. The Brownfields program has assisted with the successful redevelopment of over 50 sites in Virginia in the last three years. None of these five programs currently collect groundwater quality data; however, they do receive and review data collected by outside sources.

Hazardous Waste Groundwater Activities

Throughout the reporting period from Jan 1, 2007 – Dec 31, 2012, the DEQ implemented the requirements for groundwater monitoring and corrective action as specified by the Resource Conservation and Recovery Act (RCRA). Funding for the program activities comes from an EPA grant covering hazardous waste management activities such as permitting, closure and corrective action, as well as compliance and enforcement. The grant does not cover data collection, with the exception of quality control samples. All groundwater data are collected by the hazardous waste facilities and their consultants, and are reviewed by DEQ staff for adherence to regulatory requirements.

Under RCRA, groundwater quality is evaluated at both permitted and un-permitted facilities that have land-based units for the treatment, storage and disposal of hazardous waste. Permitted sites have to meet strict operational requirements to eliminate or minimize the risk of impacts on human health and the environment. Permits include contingency requirements mandating clean-up in case of a release of hazardous waste from a regulated unit or as identified during the site-wide RCRA Corrective Action process. Un-permitted sites are sites where operation has ceased and the facility is in the process of removing and/or decontaminating contaminated media (closure), sites where a permit is about to be issued, or sites where RCRA Corrective Action is being undertaken under an Order or agreement with EPA or DEQ. The information in the RCRA Corrective Action category in Table 6-4 has been combined into one reporting metric including both permitted and un-permitted sites.

Information provided in the Table 6-4 RCRA Corrective Action category was derived for all the sites in Virginia's 2020 Corrective Action universe, as identified by EPA. These sites, currently numbering 120, have been previously identified as exhibiting or having the potential for impacts on human health and the environment. The number of future additions to the Corrective Action universe is expected to be small.

Most facilities have more than one waste management unit, and all units need to be evaluated for potential impacts and undergo remediation if necessary. All sites are currently in various stages of evaluation and, where applicable, site clean-up. To date, groundwater impacts were identified at 59 sites. For an additional 54 sites, it was determined that groundwater has not been impacted. For the remaining 7 sites, additional investigation will be required.

At the 59 sites where groundwater monitoring has detected exceedances above applicable groundwater protection standards (such as EPA's Maximum Contaminant Levels for drinking water), facilities are required to implement clean-up measures.

Corrective action plans for interim and/or final measures to remediate impacted groundwater have been developed for 48 sites. Some type of active remediation is ongoing at 32 sites. More detailed information for each site as well as an interactive map of Virginia facilities in the RCRA Corrective Action program can be found on DEQ's web site at http://deq.state.va.us/Programs/LandProtectionRevitalization/RemediationProgram/RCRACorrectiveAction.aspx or on EPA's Corrective Action page at http://www.epa.gov/reg3wcmd/ca/va.htm
.

Source Water and Wellhead Protection Efforts

Building grassroots support for groundwater and wellhead protection continues to be priorities of the GWPSC and its member agencies. VDH met their obligations for source water assessments as outlined in the 1996 Amendments to the Safe Drinking Water Act (SDWA) and the Clean Water Act (CWA). These assessments offer a reasonable starting point for protection activities. In the fall of 2004, DEQ completed a Wellhead Protection Plan for the Commonwealth and submitted it to EPA for approval. DEQ elected to move forward with the submittal of an EPA approved wellhead protection program with the expectation of leveraging funds from the SDWA to assist localities in implementation of local plans. The plan received EPA approval in May 2005. VDH and DEQ are cooperating on a program that offers

competitive grants to local governments with groundwater based public water supplies. The funding source is the Safe Drinking Water Act Drinking Water State Revolving Fund Set-Asides. Additional information can be found at http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterProtectionSteeringCommittee/WellheadProtection.aspx including information on funding opportunities.

Table 6-1 Public Water Supply Systems and Population Served from Virginia's Source Water Assessment and Protection Reporting (as of Oct 14, 2011)

Total Number of Public Water Supply (PWS) systems	2,776
Total Number of GW-Dependent PWS Systems	2,445
Total Number of Community Water Supply Systems	1,166
Total Number of GW-Dependent Community Water Supply Systems	852
Total Population Relying on Community Water Supply Systems	6,606,184
Total Population Relying on GW-Dependent Community Water Supply Systems	495,578
Total Number of GW-Dependent Non-Transient Non-Community PWS Systems	524
Total Number of GW-Dependent Transient Non-Community PWS Systems	1,069

Pesticide Disposal Program

The Virginia Department of Agriculture and Consumer Services (VDACS) have conducted a highly popular and successful Pesticide Disposal Program since 1990. Since the Program's inception, more than 1.2 million pounds of unwanted pesticides have been collected from agricultural producers, licensed pesticide dealers and commercial pest control firms, homeowners and golf courses. There is no cost to participants.

To administer the Program, Virginia is subdivided into five regions. A pesticide disposal program is conducted annually in localities within one of the regions. Once all five regions have been served, the program starts another cycle. The Pesticide Disposal Program requires participants to transport their unwanted agricultural and commercial pesticides to a central collection site where the hazardous waste disposal contractor packages the pesticides for eventual disposal. If a participant cannot safely containerize the unwanted pesticides for transport, the disposal contractor will make such arrangements.

The pesticide disposal program has benefited from a high level of interagency cooperation among the VDACS, DEQ, DCR, DCLS, and Virginia Cooperative Extension. Initial funding to support this program was pooled from the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Clean Water Act (Sections 319 Non Point Source and 106 Groundwater Protection) grants as well as the Office of Pesticide Services (OPS) program fees. Currently, the program is supported entirely by OPS program fees. Additional information may be found at http://www.vdacs.virginia.gov/pesticides/disposal.shtml.

Plastic Pesticide Container Recycling Program

The Virginia Department of Agriculture and Consumer Services (VDACS) and Virginia Cooperative Extension (VCE) conduct an annual plastic pesticide container recycling program. Since its inception, the program has collected and granulated a total of 1,040,725 plastic pesticide containers. This equates to over one million pounds of plastic collected for refabrication.

The Plastic Pesticide Container Recycling Program addresses a challenge for agricultural producers and custom applicators. Typically, pesticide applicators dispose of their empty, clean plastic pesticide containers by hauling them to the local sanitary landfill. Recycling is an environmentally responsible alternative for the disposal of properly rinsed plastic pesticide containers. Granulated chips are transported to recycling facilities and fabricated into items such as pallets, fence posts, field drain tiles and parking stops thus keeping them out of landfills and reducing the potential for contamination from improperly rinsed containers which have either been landfilled or disposed of improperly.

To participate in the Program, a locality must make application to VDACS and agree to collect, inspect and store the properly rinsed containers until granulation. VDACS provides up to $1,875 per locality annually in reimbursement costs to participating localities to offset the cost of the program. This program is funded through OPS program fees. Additional information may be found at http://www.vdacs.virginia.gov/pesticides/recycling.shtml

Groundwater Protection Program Conclusion

Groundwater programs in Virginia strive to maintain the existing high water quality. The Virginia Groundwater Protection Steering Committee (GWPSC), established in 1986, continues to meet as a vehicle for sharing information, directing attention to important groundwater issues, and taking the lead on groundwater protection initiatives requiring an inter-agency approach. This inter-agency advisory committee is designed to stimulate, strengthen, and coordinate groundwater protection activities in the Commonwealth. Groundwater protection activities in the Commonwealth are as varied as the funding sources that support them.
http://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterProtectionSteeringCommittee/WellheadProtection.aspx

Table 6- 2 Primary Sources of Groundwater Contamination

Contaminant Source	Ten Highest-Priority Sources(/)	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications		(F) State GW Protection Strategy	(E)
Irrigation practices			
Pesticide applications		(F) State GW Protection Strategy	(A,B)
Storage and Treatment Activities			
Land application		(F) State GW Protection Strategy	(E)
Material stockpiles			
Storage tank (above ground)			
Storage tank (underground)		(F) State GW Protection Strategy	(D)
Surface impoundments		(F) State GW Protection Strategy	(E)
Waste piles			
Disposal Activities			

Landfills	□	(F) State GW Protection Strategy	(M) 40 CFR-App IX
Septic systems	□	(F) State GW Protection Strategy	(J)
Hazardous waste generators			
Hazardous waste sites			
Industrial facilities			
Material transfer operations			
Mining and mine drainage	□	(F) State GW Protection Strategy	(M) Acid Leachate
Pipeline and sewer lines			
Salt water intrusion	□	(F) State GW Protection Strategy	(G)
Urban runoff	□	(F) State GW Protection Strategy	(M) NPS pollutants such as fertilizers & heavy metals
Other sources (please specify)			

A-Inorganic Pesticides
B-Organic Pesticides
C-Halogenated Solvents
D-Petroleum Compounds
E-Nitrite
F-Fluoride
G-Salinity/Brine
H-Metals
I-Radionuclides
J-Bacteria
K-Protozoa
L-Viruses
M-Other

Table 6-3 Summary of State Groundwater Protection Programs

Programs or Activities	Check* (□)	Implementation Status	Responsible State Agency
Active SARA Title III Program	□	fully-estab.	DEQ
Ambient groundwater monitoring system			
Aquifer vulnerability assessment	□		
Aquifer mapping			
Aquifer characterization		cont. efforts	DEQ
Comprehensive data management system			
EPA-endorsed Core Comprehensive State Groundwater Protection Program (CSGWPP)			
Groundwater discharge permits (VPA)	□	fully-estab.	DEQ
Groundwater Best Management Practices			
Groundwater legislation (Quantity)	□	fully-estab.	DEQ
Groundwater classification			
Groundwater quality standards	□	fully-estab.	DEQ
Interagency coordination for groundwater protection initiatives	□	fully-estab.	DEQ
Nonpoint source controls	□	cont. efforts	VDCR
Pesticide State Management Plan (Generic)	□	fully estab.	VDACS
Pollution Prevention Program			
Resource Conservation and Recovery Act (RCRA) Primacy	□	fully-estab.	DEQ
Source Water Assessment Program	□	fully-estab.	VDH
State Superfund			EPA primacy
State RCRA Program incorporating more stringent requirements than RCRA Primacy			
State septic system regulations	□	fully-estab.	VDH
Underground storage tank installation requirements	□	fully-estab.	DEQ
Underground Storage Tank Remediation Fund	□	fully-estab.	DEQ
Underground Storage Tank Permit Program	□	fully-estab.	DEQ
Underground injection Control Program			EPA primacy
Well abandonment regulations	□	fully-estab.	VDH
Well Installation regulations	□	fully estab.	VDH

Table 6-4 Groundwater Contamination Summary

Aquifer Description Commonwealth of Virginia

Data Reporting Period January 1, 2007 - December 31, 2012

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed groundwater contamination	Contaminants	Number of site investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of Sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL		22	22	16	(A) append 9	22	17	20	20	4
CERCLIS (non-NPL)		200+	< 150	< 80	PAHs, VOCs SVOCs, metals					
Voluntary Remediation		430	300+	300+	(A) & (B)					
Federal Facilities Restoration(NPL)		13	13	13	(A), (B), others	13	13	13		
Federal Facilities Restoration (nonNPL)		31	18	18	(A), (B), others	18	18	18		
Leaking UST & AST as of DEC 2012		33,834	33,834		petroleum hydrocarbons				930	32,585
RCRA Corrective Action	PERMITTED (includes state and federal permits) and UNPERMITTED (closing, permit to be issued, or remediating under alternate mechanism	121	121	59	(A), (B), others	121		48	32	45
Solid Waste Landfills	Permitted and unpermitted (monitoring under enforcement action)	219 (total) 216 permitted 5 unpermitted	Not Applicable	94	VOCs, SOCs, metals	30	Not Applicable	64		6
State Sites										
Nonpoint Sources										
Other (specify)										

Source Type Abbreviations

NPL - National Priority List (DEQ staff: K.Greene)
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, & Liability Information System (DEQ staff:D.Harris)
Voluntary Remediation (DEQ staff: K.Greene)
Federal Facilities (DEQ staff: K.Doran)
UST & AST- Underground Storage Tanks & Above ground Storage Tanks (DEQ staff: B.Lamp)
RCRA - Resource Conservation & Recovery Act (DEQ staff: J.Schneider)
Solid Waste Landfills (DEQ staff: J.Schneider)

Notes

[1)] Information for sites with confirmed groundwater contamination only

[(2)] Information for all sites

Contaminant Type

(A) listed and characteristic hazardous waste
(B) metals, halogenated organics, POL,PCB, Pesticides

Table 6-5 Aquifer Monitoring Data

Hydrogeologic Setting [1] Commonwealth of Virginia

Spatial Description (optional) [2] _NA_____

Map Available (optional) [3] __NA_____

Data Reporting Period [4] January 1, 2007 through December 31, 2012

Monitoring Data Type	Total No. of Wells Used in the Assessment [5]	Parameter Groups	Number of Wells								
			No detection of parameters above MDLs or background levels		Nitrate concentrations range from background levels to less than or equal to 5 mg/l No detection of parameters other than nitrate above MDLs or background levels and/or located in areas that are sensitive or vulnerable		Nitrate ranges from greater than 5 to less than or equal to 10 mg/l Other parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs [10]	Parameters are detected at concentrations exceeding the MCLs [11]	Number of wells removed from service [12]	Number of wells requiring special treatment [13]	Background parameters exceed MCLs [14]
			ND [6]	Number of wells in sensitive or vulnerable areas (optional) [7]	Nitrate ≤5mg/l VOC, SOC, and other parameters not detected [8]	Number of wells in sensitive or vulnerable areas (optional) [9]					
Finished Water Quality Data from Public Water Supply Wells	3,597	VOC	8,285								
		SOC [15]	6,072								
		NO_3	9,024		792						
		Other [16]									

These numbers are provided by the Virginia Department of Health, Office of Drinking Water (J.Vivas). Data is given for wells associated with mixed systems (surface and groundwater) and groundwater based systems. SOC data is limited due to waiver programs and no detections in systems that were monitored. VOC and SOC data may be incomplete due to optional data entry requirements in VDH field offices. MCL exceedence information required additional work that VDH staff limitations prevented. Software modernization efforts underway at EPA may make providing this information in future reports an easier task. Ambient data, Untreated Water Quality data from PWS, and unregulated well data is not collected or not available.

Column 5: Total number of wells (3,597) is a subset of sample results for VOC, SOC, and NO. There may be multiple sample results for a single well.
Column 6: No detections for NO3 analysis (9,024) is a combined total of sample results for contaminants 1038 and 1040.